Embedded questions and concealed relative questions in Hausa and Akan[1]

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Abstract. The central goal of this paper is to instigate cross-linguistic research on the interpretation of embedded interrogatives and concealed relative clauses. The empirical focus is on the West African languages Hausa and Akan, which prominently employ relativized DPs for expressing embedded questions. The paper first discusses the different ways for interpreting and analyzing embedded *wh*-interrogatives: interpretations vary from strong exhaustive via intermediate and weak exhaustive to non-exhaustive. We will then present data on *concealed relative questions* in Hausa and Akan, focusing on the issues of how such structures are compositionally interpreted, and how they behave in terms of (non-) exhaustivity. Drawing on existing analyses of concealed and interrogative questions in English, we tentatively propose two formal analyses for concealed relative questions in the two languages discussed.

1 Introduction: Embedded interrogative questions in English

Embedded questions in English are proto-typically realized in the form of *yes/no*- or *wh*-interrogatives, which occur embedded under a range of predicates (Karttunen 1977):

(1) Sigurd knew/ found out/ told us/ was surprised at **[$_{CP}$ who left]**.

Two central questions on embedded *wh*-interrogatives are what their semantic interpretation is eg. in terms of exhaustivity, and how this interpretation comes about. In particular, what is the meaning contribution of the embedded (interrogative) clause? What is the contribution of the embedding predicate? And what is the contribution of (covert) EXH-operators, if any? In response to these questions, the following assumptions are commonly made: (i.) Embedded questions as in (1) take the form of interrogative clauses, which denote alternative propositions (Hamblin 1973, Karttunen 1977) or partitions (Groenendijk & Stokhof 1984) at some level of their compositional semantic derivation; (ii.) The interpretation of embedded *wh*-interrogatives as (non-)exhaustive is variable, depending on context and embedding predicate. The observable surface interpretations of embedded interrogatives are derived from the interaction of alternative propositions with (lexicalized) EXH- or MAX-operators, or from the absence of such operators.

The core objective of this paper is to take a closer, cross-linguistically informed look at these basic assumptions on the meaning of embedded questions. The study of questions focuses for the most part on Western Indo-European languages (German, Romance, Slavic). But, to my knowledge, there is no systematic formal semantic work on the meaning of embedded questions in African languages, at least some of which seem to differ in the way in which embedded questions are structurally realized. For instance, Hausa (Chadic, Afro-Asiatic) has two alternative

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ways for expressing embedded questions. First, as an embedded *wh*-interrogative (2a). Secondly, as a complex relativized DP (2b), or so-called *concealed relative question* (CRQ):

(2) a. Musa ya san [wà / wàne (ne) ya tàfi Kano]
Musa 3SG.M.PFV know who.SG / WHO.SG.M. FOC 3SG.M.PFV go Kano
'Musa knows who went to Kano.'
b. Musa ya san [wa-n-dà ya tàfi Kano]
Musa 3SG.M.PFV know one.SG-DEF.M-REL. 3SG.M.PFV go Kano
'Musa knows who went to Kano.' (lit.'Musa knows the one that went to Kano.)

In §3, we show the CRQ-strategy to be preferred in out-of-the-blue translations into Hausa, whereas with most embedding predicates it seems to be the only available strategy for coding embedded questions in Akan (Kwa, Niger-Congo). The question is, then, how to derive embedded question meanings from the meaning of relativized DPs. More generally, the findings on Hausa and Akan point to the importance of concealed questions (CQs), as exemplified in (3). CQs are often treated as marginal in English, and yet, judging by the Hausa and Akan data, they seem to be a common cross-linguistic source for embedded question interpretations:

(3) John knows the winners / the persons that won. (= knows who the winners are)

Also, connecting the formal analysis of concealed questions (CQs) with embedded *wh*-interrogatives, the question arises what predictions such analyses will make for the interpretation of CRQs as strongly, weakly or non-exhaustive. This question is normally set aside in the analysis of CQs, cf. Nathan (2006:27), but will be explicitly addressed in §4.

The paper is structured as follows. Section 2 discusses the (EXH-)interpretation and formal analysis of embedded *wh*-interrogatives in English. Section 3 introduces data from Hausa and Akan, focusing on the phenomenon of CRQs. Section 4 discusses three analyses of English CQs, focusing on the questions of how such structures are compositionally interpreted, and how they behave in terms of (non-) exhaustivity. Whereas most analyses treat CQs as strongly exhaustive, the analysis in Nathan (2006) is compatible with a weak exhaustive interpretation of CQs. This, in turn, would be compatible with variability in the EXH-interpretation of CRQs in Hausa and Akan. We will sketch a Nathan-style analysis for Hausa, juxtaposing it to a competing analysis in terms of Xiang's (2016) choice function-based analysis of *wh*-interrogatives. Section 5 concludes. Note that the results are preliminary in that data on Hausa and Akan come from only one speaker each. There is thus urgent need for further empirical confirmation; see eg. FN4.

2 Interpretation of embedded interrogatives in English: Data and Analysis

2.1 Variable Interpretation: Different degrees of (non-) exhaustivity

Embedded interrogatives allow for up to four different interpretations depending on embedding predicate and context: Strong exhaustive (SE), non-exhaustive (NE), weak exhaustive (WE), and intermediate exhaustive (IE). SE interpretations are found with the matrix predicate *know*, as in

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(4a). For (4a) to be true, Sigurd knows for everybody that left that she left and he knows for everybody that didn't leave that she didn't leave. That is, Sigurd knows the complete true answer, and he knows that this is the complete true answer. Therefore, (4a) is equivalent to its negated counterpart (4b) (Groenendijk & Stokhof 1984). The SE reading is modelled in (5).

(4) a. Sigurd knows [who left]. ⇔ b. Sigurd knows [who didn't leave].

(5) $[\![\text{who left}_{SE}]\!]^w = \lambda p_{<s,t>}.\exists x[p(w) \wedge p = \lambda w'.$ x left in w' and nobody else left in w']

At the opposite end of the EXH-scale, there are NE *mention-some* questions: These typically contain a possibility modal as in (6a) (Groenendijk & Stokhof 1984, Xiang 2016: 38), and they can be modelled as denoting sets of propositions containing at least one true answer, (6b).

(6) a. Pekka learnt [where he can purchase a Finnish newspaper].
(eg. Pekka found out that he can buy a Finnish newspaper at Suomen Kauppa)
b. $[\![\text{where P. can purchase a Finnish newspaper}_{NE}]\!]^w = P_{<st,t>}$, such that $P \subset \{\lambda w.$
Pekka can purchase a Finnish newspaper in x| x∈SHOP}and ∀p∈P[p(w)]

NE interrogatives show indefinite behavior in denoting restricted variables, corresponding to the behavior of the indefinite determiners in (7) (Heim 1982). The semantic effect can be modelled by means of choice functions (Reinhart 1997, Xiang 2016):

(7) $[\![\text{a/some man}]\!] = f_{CH}([\![\text{man}]\!]) = x$, such that $x \in [\![\text{man}]\!]$

WE embedded interrogatives as in (8a), by contrast, denote propositional sets containing the complete list of true answers (and nothing else), as in (9). Because of this, WE interrogatives are not equivalent to their negated counterpart (8b). In (8a), for instance, Jaden may be surprised at everybody who is dating Karina, but not at who is not.

(8) a. Jaden is surprised at [who is dating Karina]. ≠
b. Jaden is surprised at [who is not dating Karina].

(9) $[\![\text{who is dating Karina}_{WE}]\!]^w = \lambda p_{<s,t>}.\exists x[p(w) \wedge p = \lambda w'.$ x is dating Karina in w']

WE readings are commonly found with emotive/cognitive verbs such as *be surprised at* or *wonder* (Berman 1991, Heim 1994:139). They are also attested with the communication verbs *tell*, *remind*, and *write down* (Karttunen 1977:11, Heim 1994:137). (10) illustrates for *tell*:

(10) John told Mary (correctly) who passed the test, …
(≈ John gave Mary the complete list of people who left)
(i) …, but his list mistakenly included a few students that did not.
(ii) …, indeed, in his eagerness, he even named a few students that did not.

Finally, Spector (2006), Klinedienst & Rothschild (2011), and Uegaki (2015) claim that embedded interrogatives can also have intermediate exhaustive readings. Predications of the

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form *X P [wh]* with factive or cognition verbs (*discover*) and with non-factive communication verbs (*tell, predict*) are claimed to be true if x stands in P-relation to all true answers to *wh*, and, moreover, X stand in no P-relation to any false answer to *wh*. Accordingly, (11a) will be IE-true if Arthur told us for everybody who sang that this person sang and for everbody else, Arthur did not make any false claims that this person sang. Likewise, Cremers and Chemla (2016) show in an experimental study that speakers judge (11b) as true in an IE-scenario: All blue squares are correctly predicted, and there's no false prediction that any of the non-blue squares be blue.

(11) a. Arthur told us [who sang].
b. John predicted [which of the four squares were blue].

In sum, embedded interrogatives may have up to four different surface readings, as informally summarized in (12), where WE stands for the set of true answers to the question. The four readings are ordered in terms of logical strength SE>IE>WE>NE: If a question clause is true on a stronger reading to the left, then all weaker readings to the right are entailed to be true as well.

(12) a. SE: **All p∈WE are true** & all q∉WE are false (= Only p's∈WE are true)
b. IE: **All p∈WE are true** & and ¬∃q∉WE that is falsely claimed to be true.
c. WE: **All p∈WE are true**
d. NE: **There is some P⊂WE**, such that the elements of P are true

In conclusion, we list a few potential confounds for the empirical investigation of the meaning of embedded interrogatives: The domain of quantification may be uncertain (George 2011, G&S 1984:87), or there may be non-complementary background predicates (George 2011:88f.). Verbs of saying like *tell* oscillate between veridicality and non-veridical interpretations (Egré and Spector 2015). The intended granularity of the answer may differ (eg. Lahiri 2002), and there may be various conceptual covers associated with possible answers (Aloni 2001). These factors must be controlled for in experiments and fieldwork on embedded question interpretation.

2.2 Formal Modelling

The literature offers various ways for modelling the (non-)exhaustive interpretationof questions. The analyses differ in the underlying interpretation assigned to embedded interrogatives as well as in the origin of the EXH-effect, if present. We can distinguish between Q-operator, lexical, and covert MAX/EXH/ANS-operator accounts, respectively.

In Q-operator approaches, the interrogative semantics is essentially determined by the workings of a left-peripheral question operator, predicting a uniform semantic interpretation. For Karttunen (1977), *wh*-interrogatives come with underlying WE-readings: The set of true propositions (<st,t>) is derived from the interaction of Q-operator and existential *wh*-expression:

(13) a. $[\![\text{wh}_i\ Q]\!] = \lambda q_{<st>}.\lambda w_{<s>}.\lambda p_{<st>}.\ \exists x\ [p(w) \wedge p = [\lambda x_i.q](x)]$
b. $[\![$ who Q is dating K. $]\!]\ (w) = \lambda p_{<s,t>}.\ \exists x\ [p(w) \wedge p = \lambda w'.$ x is dating K. in w']

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For Groenendijk & Stokhof (1982, 1984), by contrast, interrogatives come with a basic SE-interpretation: They denote a partition that is derived from the meaning of Q plus λ-abstraction over the *wh*-index. The extensional type of embedded interrogative is thus <st>.

(14) a. $[\![\text{wh}_i \text{ Q}]\!] = \lambda q_{<st>}.\lambda w.\lambda w'.\ [\ \lambda x_i.q(w') = \lambda x_i.q(w)\ ]$
b. $[\![$ who is dating K.$]\!](w) = \lambda w'.$ [λx.x is dating K. in w' = λx.x is dating K. in w]

In lexical approaches, the semantics of embedded interrogatives is largely determined by the embedding predicate. Such approaches typically assume a Karttunen-style WE-interpretation for the embedded interrogative. For Heim (1994:133), the SE-interpretation typically observed with interrogatives embedded under *know* (3) comes from the lexical meaning of this predicate: *To know a question* means to know the SE-answer to this question in the sense of G&S (1984):

(15) a. $[\![\text{know}]\!](w)(q)(x) = 1$ iff x believes $\lambda w'[q(w') = q(w)]$ in w
b. $[\![$ Sigurd knows who is dating Mary $]\!](w) = 1$ iff
Sigurd believes the proposition that the set of true answers to question intension q is the set of true answers to q in evaluation world w, i.e. he believes the complete answer and he also believes that this is the complete answer.

Crucially, *know* differs from other embedding predicates such as *be surprised at* or *tell*, which do not require access to a full SE- partition, but simply express an attitude to the conjunction of all true answers (WE), some true answer (NE), or even to the question intension q with *wonder* or *ask*; cf. (23) to (25) below. The lexical account is thus well-suited for capturing variability in the interpretation of embedded interrogatives. In the same vein, Spector (2006) proposes that embedding predicates are potentially three-ways ambiguous between SE-, WE- and IE-reading.

Other accounts model the variable EXH-interpretation of embedded interrogatives by adding covert semantic operators to a basic WE interrogative interpretation. For instance, Rullmann & Beck (1999) derive the SE-reading from the underlying WE-reading by inserting a covert maximality (MAX)-operator at LF. The function of MAX is to pick the maximal true answer from the set of true answers. Klinedienst & Rothschild (2011), assume three semantic readings for embedded interrogatives: Their basic interpretation is WE. IE- and SE-readings are derived by inserting a covert EXH-operator in matrix or embedded clause, respectively:

(16) a. **WE:** Pred [wh-interrogative] b. **SE:** Pred [EXH [wh-interrogative]]
c. **IE:** EXH [Pred [wh-interrogative]]

The matrix subject is required to have a P-attitude towards the complete list of true answers in WE (16a), to have a P-attitude towards the exhaustified list of true answers in SE (17b)(eg. to know the full list and knowing that it is the full list), and to have an exhaustified P-attitude to the full list of true answers in IE (16c) (i.e. no P-attitude to false answers). Uegaki (2015) presents a slightly modified picture, according to which interrogatives have but two distinct LFs, namely the WE- and IE-configurations in (16a) and (16c), respectively, whereas the SE-reading is pragmatically derived. Finally, Theiler (2014) deviates from most operator accounts in assuming basic NE reading for embedded interrogatives. The WE-reading is derived by adding a [+completive] ANS(wer)-operator, the strong reading by combining ANS- and EXH-operator.

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In the past 20 years or so, then, most researchers take the WE Karttunen- interpretation to be the basic reading of embedded questions, which is presumably coded in a question-mood operator. Furthermore, there is a general consensus that the [+/-EXH]-interpretation of embedded questions is to some extent flexible. Importantly, the study of embedded questions focuses largely on embedded *wh*-interrogatives in European languages. From a cross-linguistic perspective, this raises the question of whether CRQs in Hausa and Akan are as flexible as English interrogatives, or whether they have stronger underlying EXH-interpretations. This question is highly relevant because it is not clear that interrogatives are indeed the preferred strategy for realizing embedded questions across languages: as will be shown below, the preferred strategy in Hausa and Akan are CRQs. If so, the analysis of EXH-effects in embedded questions will have to rely on the analysis of such CQRs and also of free relative-based questions in English (Caponigro 2003). Differences in the interpretation of interrogatives and CRQs might then be responsible for the co-existence of two embedded question strategies in Hausa, cf. (2).

3 Concealed Relative Questions in Hausa and Akan

As already mentioned in §1, the two typologically unrelated West African languages Hausa and Akan have a second strategy for expressing question embedding, next to *wh*-interrogative clauses: CRQs in Hausa were illustrated in (2), repeated here.[2]

(2) a. Musa ya san [wà / wàne (ne) ya tàfi Kano]
Musa 3SG.M.PFV know who.SG / WHO.SG.M. FOC 3SG.M.PFV go Kano
'Musa knows who went to Kano.'

b. Musa ya san [wa-n-dà ya tàfi Kano]
Musa 3SG.M.PFV know one.SG-DEF.M-REL. 3SG.M.PFV go Kano
'Musa knows who went to Kano.' (lit.'Musa knows the one that went to Kano.)

Newman (2000: 502, my emphasis) points out that "One can express the semantic equivalent *(more or less)* of an indirect question by means of a relative clause construction headed by a noun or a relative pronoun." Indeed, CRQs were offered as spontaneous translations of the corresponding *wh*-interrogatives in English, suggesting that they may indeed be the preferred choice for expressing embedded questions in Hausa.

Next to the verb *sani* 'know' in (2), CRQs were solicited as translations for *wh*-interrogatives with different verbs of cognition and communication, as illustrated in (17a) to (19a). The (b/c)-sentences show the corresponding *wh*-interrogatives to be licit as well, except under the verb *annabta* 'predict' in (19b) (H. Abubakari, p.c.):

[2] Hausa examples are presented in Boko script with L tone diacritics (`). Akan examples are given without tones.

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(17) **Translated:** 'It ***surprised*** Musa [who went to Kano].'
a. Yaa baa Musa màmakì (game) dà [wa-n-dà ya tàfi Kano]
3SG.M.PFV give Musa surprise about P one.SG-DEF.M-REL 3SG.M.PFV go Kano
b. Musa ya **yi màmakì-n** [**wàne (nè) ya/wàce(cè) ta** tàfi Kano]
Musa 3SG.M.PFV do surprise-of who.M.SG 3SG.M.PFV/who.F.SG 3SG.F.PFV go Kano
c. Musa ya **yi màmakì-n** [**wà** ya/ta tàfi Kano]
Musa 3SG.M.PFV do surprise-of who.SG 3SG.PFV.M/F go Kano

(18) **Translated:** 'Musa ***told*** us [who went to Kano].'
a. Musa ya fàd'a manà [**wa-n-dà** ya tàfi Kano]
Musa 3SG.M.PFV tell 1PL-IO one.SG-DEF.M-REL 3SG.M.PFV go Kano
b. Musa ya fàd'a manà [**wàne (nè)** ya/**wàce(cè)** ta tàfi Kano]
Musa 3SG.M.PFV tell 1PL-IO who.M.SG3SG.M.PFV/who.F.SG 3SG.F.PFV go Kano
c. Musa ya fàd'a manà [**wà** ya/ta tàfi Kano]
Musa 3SG.M.PFV tell 1PL-IO who.SG 3SG.PFV.M./F. go Kano

(19) **Translated:** 'Musa ***predicted*** [who went to Kano].'
a. Musa ya annabtà gàme dà [**wa-n-dà** ya tàfi Kano]
Musa 3SG.M.PFV predict about one.SG-DEF.M-REL 3SG.M.PFV go Kano
b.*?Musa ya annabtà (gàme dà) [**wà** ya/ta tàfi Kano]
Musa 3SG.M.PFV predict about who.SG 3SG.PFV.M./F. go Kano
Intended: 'Musa predicted who went to Kano'

The infelicity of (19b) is surprising from the perspective of English CQs, for which the following generalization holds (Aloni & Roelofsen 2011: 471): "A generalization that emerges […] is that any verb that selects for CQs also selects for *wh*-complements"; cf. also Baker (1968). By contrast, the Hausa verb *annabta* selects for a relative concealed question, but not for a *wh*-complement. The variable realization of embedded questions as *wh*-interrogatives or CRQs in Hausa raises a more general question about the interpretive potential of the two structures: Are they equivalent in expressive power? Or do they differ in terms of answerhood conditions, presuppositions, or exhaustivity? Empirically, semantic equivalence would predict free substitutability *salva veritate*, i.e. a parallel distribution. Differences in semantic interpretation would be correlated with differences in syntactic and contextual distribution.

Notice that the difference between *wh*-interrogatives and CRQs does not per se lie in the fact that the latter are overtly specified for [number] and [gender] features, presumably in the form of a presupposition restricting question domain and answer space. While this additional information certainly adds to the expressive force of CRQs, we can observe that the same is possible with the *wh*-interrogatives in (2) and (17b/18b), in which number and gender of the individual(s) in question are explicitly specified by *wane ne* (M.SG), *wace ce* (F.SG) and *suwa(ne ne)* (PL) and by the relative form of the preverbal person-aspect marker (Newman 2000).[3] If anything, Hausa displays a split between number-gender specified *wh*-interrogatives and their underspecified counterparts (with bare *wa* 'who') in the (c)-clauses: The gain in expressive power by

[3] It is possible that the gender-number specification expressed by *nee/cee* is responsible for the emergence of exhaustivity effects with *wh*-interrogatives and focus constructions with *nee/cee* (Hartmann & Zimmermann 2007).

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number/gender-specification is thus not restricted to CRQs, so that these cannot be preferred on grounds of greater informativity. A similar situation obtains in English, which also displays a split between obligatorily specified CQs (20a) and *which*-NP-interrogatives (20b), on the one hand, and unspecified bare *wh*-interrogatives, on the other (20c) (Xiang 2016).

(20) a. John found out [the winner/s]. specified for [SG] / [PL]
b. John found out [which participant/s won]. specified for [SG] / [PL]
c. John found out [who won]. unspecified for [number]

The observable parallels between Hausa CRQs and the English concealed question in (20a) raise the question of whether CRQs in Hausa (and Akan) come with the specific characteristics of concealed DP-questions in English, to be discussed in §4. This position receives intuitive support from the observation that the presence of restrictive relative modifiers supports the semantic construal of embedded DPs as CQs in English, too (Nathan (2006:118f.).

CRQs are also regularly found in Akan, cf. (21a). Embedded *wh*-interrogatives are possible as well, at least with the embedding predicate *ask* (Saah 1994:77f.), (21b):

(21) a. Kwadwo **nim** [**nipa** **ko** [**aa** ɔ-kɔ-ɔ Kumase]].
Kwadwo know person one REL 3SG-go-PAST Kumasi
'Kwado knows the person that went to Kumasi.' (≈ K. knows who went to K.)
b. Mary **bisa-a** [sɛ **hena** **na** o-huu Kofi]
Mary ask-PST COMP who FOC 3SG-saw Kofi
'Mary asked who saw Kofi.'

Still, the distribution of embedded *wh*-interrogatives in Akan seems much more restricted than in Hausa. Preliminary investigations suggest that CRQs under verbs other than *wonder* or *ask* have no *wh*-interrogative counterparts. Korsah (p.c.) remarks for question embedding under *know* and *tell* that "[a]s far as I can tell, Akan has only the relative strategy". (22) shows a CRQ with *tell*:[4]

(22) Kwadwo **ka-a** [**nipa** **ko** [**aa** ɔ-kɔ-ɔ Kumase]] kyerɛ-ɛ Adwoa.
Kwadwo tell-PST person one REL 3SG-GO-PST Kumasi show-PST Adwoa
'Kwadwo told Adwoa the person that went to Kumasi.' (… who went to K.)

Same as in Hausa, the head noun of the relative clause in (21a) and (22) is specified for number (by *ko*), thereby making CRQs more informative than their *wh*-interogative counterpart in (21b). This might, at least in part, account for the general choice of CRQs over bare *wh*-interrogatives.

The possibility of embedded *wh*-interrogatives under matrix verb *bisa* 'ask' in (21b) may be due to selectional restriction. For instance, Aloni & Roelofsen (2011:474) analyze the question-

[4] There appears to be some inter-speaker variation in the expression of embedded questions in Akan. A second speaker consistently rejected embedded *wh*-interrogatives as well, but he volunteered a different relative question construction involving a free relative clause without overt head NP, cf. the variant of (21a) in (i).
(i) Kwadwo nim [deɛ/nea ɔ-kɔ-ɔ Kumase]
Kwadwo know REL_{FREE} 3SG-go-PAST Kumasi

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embedding predicate *wonder* in (24a) as selecting for propositional concepts of type <s,<st>>. From this, they derive the incompatibility of *wonder* with CQs (23b).

(23) Alex is wondering a. [$_{CP}$ how much the milk is] (no answer expected)
b. *[$_{DP}$ the price of milk]

The verbs *ask* and *wonder* indeed seem to express an epistemic subject's relation to an abstract question meaning, and not to the (more or less) exhaustive answer to this question. This is different with the variant *ask for* (German *erfragen*), which expresses a relation between the subject and the answer to the question *What is the price of milk*?

(24) a. *Alex **asked** [the price of milk].[5] b. Alex **asked for** [the price of milk].

If Akan *bisa* 'ask' turns out to be also incompatible with CRQs, we can postulate the following lexical entry for proper question-embedding predicates (*q* = intensional question meaning).

(25) ⟦ wonder / ask / bisa ⟧
= $\lambda q_{<sst>}. \lambda x_{<e>} .\lambda w. \forall w' \in BOUL_{x,w}$: x finds out the w-true answer to q in w'.

Interestingly, the CRQs in (21a) and (22) feature the (specific) numeral marker *ko* on the head NP, and not the DEF-marker *no.* This raises the question of whether CRQs can be introduced by both indefinite and definite NPs, as shown in (26ab), with corresponding NE or WE/SE-reading:

(26) a. with *ko*: Kwadwo knows **a** person that went to Kumasi. (NE)
b. with *no*: Kwadwo knows **the** person that went to Kumasi. (WE/SE)

Alternatively, *ko* might denote a choice function,[6] which, depending on whether or not the complex relative NP denotes a singleton set, will result in NE or WE/SE-interpretation. Choice functions play a crucial role in the question analysis of Xiang (2016), to which we turn in §4.3.

4 Concealed Questions: Meaning Composition and Exhaustivity

In this section, we first introduce the semantic characteristics of English CQs (§4.1). As will emerge, CQs are semantically more restricted than their *wh*-interrogative counterparts. In §4.2, we briefly present three formal analyses of CQs focusing on the compositional procedure and predictions on question exhaustivity, if any. As will be shown, any analysis of CQs will have to resort to some sort of type-shift in order to raise the basic DP denotation to the propositional level. Finally, we will sketch two possible analyses for Hausa and Akan CRQs in §4.3, one based on the CQ-analysis of Nathan (2006), the other on the *wh*-interrogative analysis in Xiang (2016).

[5] But see Nathan (2006:44, ex.29g) for a diverging grammaticality judgment.
[6] See e.g. Renans (2017) for a choice function-analysis of indefinite numeral *ko(me)* 'one' in related Gaa (Kwa).

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4.1 Semantic characteristics of English concealed questions

In English, many attitude verbs allow for CQs in combination with object DPs. For instance, the prominent interpretation of (27a) is that Marc knows what the price is. And (27b) has a reading on which Marc knows which price Fred knows (without necessarily knowing the amount). In general, CQs can denote into the same semantic dimensions as *wh*-interrogatives, cf. (28):

(27) a. Marc knows [$_{DP}$ the price] NOT: *'Marc knows 3 kronor.'
b. Marc knows [$_{DP}$ the price that Fred knows].

(28) a. John knows the president of the US. = who the POTUS is
b. John knows the meeting place. = where the meeting place is
…
c. John knows the manner in which to succeed = how to succeed

As already discussed in connection with Hausa (19), English CQs can be embedded under a subset of predicates selecting for wh-interrogatives (Nathan 2006:44, Roelofsen & Aloni 2011:471), including *know*, *forget*, *learn*, *discover*, *tell*, *show*, *decide*, *predict*, *investigate* etc.,

Importantly, (definite) CQs in English always denote specificational or identity questions (Nathan 2006, Romero 2007): CQs are questions about the identity of the semantic value of a definite description, i.e. an individual concept (29, 30a). CQs never denote predicational questions about properties of contextually specified individuals, such as eg. *What is x?*, (30b).

(29) $[\![\text{CQ}]\!] =$? $[\![\text{the NP}]\!] = x_{<s,e>}$

(30) a. Margret knows [the capital of Italy]. = Margret knows that the coI is Rome.
(QUD: The capital of Italy is what city?)
b. Margret knows [Rome]. (no CQ interpretation)
≠ Margret knows that Rome is the capital of Italy. (QUD: What is Rome?)

Nathan (2006:21) concludes that "insofar as a concealed question denotes a question, that question is an identity question, i.e. one of the form who X is or what X is".[7] Because of this semantic restriction to specificational question meanings, English CQs have a narrower distribution than *wh*-interrogatives. Moreover, English CQs do not allow for deictic reference even on their specificational readings, unlike *wh*-interrogatives. Nathan (2006:22) observes that *which one DP is* is not a possible meaning of CQs, accounting for the infelicity of (31):

(31) I bought milk at the store (with a couple of other things). The receipt lists three unnamed items: one cost $1.49, the second cost $1.99, and the third cost $2.49.
#I don't know [the price of milk]. (cf. I don't know which one the price of milk is.)

[7] CQs pattern with *it*-clefts, which allow for specificational, but not for predicational interpretations (Percus 1997).

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Finally, CQs are semantically more restricted than identificational *wh*-interrogatives in not allowing for *de re*-interpretations (Greenberg 1977). (32b) must be interpreted de dicto.

(32) a. John found out [who the murderer of Smith was].
eg. 1 if John found out the identity of The Strangler (who also murdered Smith)
b. John found out the murderer of Smith.

To sum up, English CQs are more restricted in semantic interpretation and distribution (under embedding predicates) than their wh-interrogative counterparts. This directly accounts for the limited occurrence of CQs and the preference for *wh*-interrogatives in English. Moreover, it would account for why *wh*-interrogatives exist side by side with CQRs in Hausa: If the latter are more restricted semantically, the expression of other interpretations might rely on *wh*-interrogatives. Still, this does not account for why CRQs are preferred out of the blue in Hausa, unless embedded questions are identificational questions per default. Also, it does not account for why relative questions are the only available option in Akan in most cases. We need to establish whether the restriction to CRQs in Akan entails a corresponding loss in expressivity.

4.2 Compositional derivation and exhaustivity of English CQs

This section gives a brief overview of three recent formal analyses of CQs in English, focusing on the compositional derivation and the predicted level of exhaustivity. The analyses in Romero (2007) and Aloni & Roelofsen (2011) appear to predict CQs to come with obligatory SE-readings (at least under the verb *know*). This is because they resort to the workings of maximality or partitioning (SE-) operators in deriving propositional question meanings from underlying individual concepts denoted by DPs. The analysis in Nathan (2006), by contrast, appears more flexible re exhaustivity, as type-shifting applies to (relative) NP-meanings, and the maximality operator denoted by the definite article only applies at the propositional level.

For Romero (2007), English CQs denote proposition intensions (<s,st>). The CQ-meaning is derived by letting the partitioning operator ANS_{STR} of type <se,<s,st>> in (34a) apply to the individual concept meaning of the (definite) DP, thereby raising it to propositional level. Because of partitioning, the resulting CQ comes with an SE-interpretation (34bc).

(33) [The price of milk] is known to John.

(34) a. $ANS_{STR} = \lambda y_{<s,e>}\lambda w\lambda w'.$ **y(w') = y(w)** (y = w*.ιxe[price(x,milk,w*)])
b. ⟦[ANS_{STR} The price of milk]$_{CQ}$ ⟧
= λwλw'.[**λw*.ιxe[price(x,milk,w*)](w') = λw*.ιxe[price(x,milk,w*)](w)**]
= λwλw'.[**ιxe[price(x,milk,w')] = ιxe[price(x,milk,w)]**]
c. ⟦[ANS_{STR} The price of milk]$_{CQ}$ is known to John ⟧
= λw.∀w'∈Dox_j(w) **[ιxe[price(x,milk,w')] = ιxe[price(x,milk,w)]]**

Romero's proposal leaves open the possibility that DP_{CQ}-meanings also combine with an ANS_{WE}-operator, but this would still require some type-shifting of the individual concept DP-meaning to propositional level. Assuming the operator meaning in (35), (33) would come out true iff John knows that there is a unique maximal price of milk, and what this price of milk is.

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(35) $ANS_{WE} = \lambda y_{<s,e>}\lambda w.\lambda p_{<st>}.\ \exists x[\ p(w) \wedge p = \lambda w'.\ x = y(w')]$ [cf. Nathan 2006:81]

It follows that John knows that nothing else is this maximal price of milk: The SE-effect persists in (35) because the individual concept meaning of DP_{CQ} interacts with semantic identification.[8]

The cover-based pragmatic analysis of CQs in Aloni & Roelofsen (2011:451-2) resembles Romero's analysis in important ways. SE is directly built into the meaning of a partitioning operator '?', cf. (36a), which is present in all CQs. And again, a type-shifting operator, namely '↑' in (36b) applies to the individual concept meaning of the DP, which is subject to pragmatic cover resolution. The operator *?x* in (36a) picks out all and only those worlds v in which φ is assigned the same truth value as in w under the same cover resolution of x to c. If P in (36b) is contextually resolved to the identity relation *λy. y = z*, and z to the (default) naming cover, this gives rise to the identity question reading. On this pragmatic resolution, (37a) would come out as true, for instance, iff John knows (K_j) which element from the naming cover *[Rome, Athens, ...]* is identical to the individual concept *ιx.x is capital of Italy*, cf. (37b), The interaction of *?*-operator, identification and DP-meaning (<s,e>) yields an SE-reading.

(36) a. $[\![?x.\varphi]\!]_{M,w,gR} = \{v \mid \forall c \in R(x): [\![\varphi]\!]_{M,w,gR[x/c]} = [\![\varphi]\!]_{M,v,gR[x/c]}\}$
b. $\uparrow_{(z,P)} \alpha = ?z.P_{<se,t>}(\alpha)$; P a contextually given predicate of individual concepts

(37) a. John knows the capital of Italy.
b. $K_j(?z.[\lambda y_{<se>}.y = z](\iota x.\ x \text{ is capital of Italy})) = K_j(?z.z = \iota x.x \text{ is capital of Italy})$

The analysis in Nathan (2006) differs regarding the semantic type of CQs and the compositional derivation. For Nathan, CQs denote unique propositions (<st>), derived by type-shifting the meaning of relational NPs (<e,et>) to propositional level (<st,t>). The DEF-operator applies at the propositional level, picking the unique proposition in a given context C, cf. (38):

(38) $[\![\text{the mayor of Berlin}]\!] = \iota p_{<st>}.\ [[\ \exists x_e.p = \lambda w_1.[\![\text{mayor of B}]\!](x)(w_1)] \wedge C(p)]$

The DP_{CQ} in (38) denotes the unique proposition *p* such that (a) for some individual *x, p* expresses that x is A mayor of Berlin, and (b) *p* meets a contextual restriction *C*, most frequently, that it be true in evaluation world *w*. According to Nathan (2006:18), the sentence *Rajesh knows the mayor of Berlin* will then be true if Rajesh knows the proposition that Michael Müller is the mayor of Berlin. Crucially, Rajesh's knowing the unique true proposition of the form *λw.x is mayor of Berlin* does not entail his knowing that this IS the unique true proposition, at least on a *de re*-construal of (38), thereby making (38) compatible with WE-interpretations; see FN9.

As Nathan's question-type shifter applies to relational nouns only, he postulates (ibid.:19) that a DP can be a concealed question iff its head noun is relational, or, in case of non-relational head nouns, if it is modified in certain ways, eg. with a relative clause. On a type-shifted interpretation, the RC maps NP-interpretations of type <et> to sets of propositions, cf. (39):

[8] Cf. Nathan (2006) for discussion, as well as Rullmann (1995) and Beck & Rullmann (1999) for precursor analyses with MAX-operators in *wh*-interrogatives.

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(39) a. ⟦that Kim visited last month⟧ =
$\lambda P_{<s,et>}.\lambda p_{<st>} . \exists x_e [p = \lambda w_1 . [P(w_1)(x) \wedge$ Kim visited x last month in $w_1]]$
b. ⟦city that Kim visited last month⟧ =
$\lambda p_{<st>} . \exists x_e [p = \lambda w_1 . [[\![city]\!](w_1)(x) \wedge$ Kim visited x last month in $w_1]]$
c. ⟦the city that Kim visited last month⟧ =
$\iota p_{<st>} . \exists x_e[p = \lambda w_1.[[\![city]\!] (w_1)(x) \wedge$ Kim visited x last month in $w_1]] \wedge p(w)$

Nathan's treatment of CQs is relevant for three reasons when it comes to the analysis of CRQs in Hausa and Akan: Firstly, it offers an explicit formal analysis of the semantic role of relative clauses in CQ-formation. Secondly, the meaning of CQs does not involve partitioning (SE), nor a maximality/uniqueness condition on individual (concept)s (SE). Nathan's approach is thus compatible with a more flexible interpretation of CRQs, at least in principle, in also allowing for WE-interpretations. Finally, the analysis is not built around individual-denoting DPs, for which reason is extends easily to CQs with indefinite determiners (and NE *mention-some* interpretations). This may be useful for the analysis of CRQs containing specific indefinite determiners in Akan (21a) and (22), for instance. More generally, the different predictions on the interpretation of CQs underline the need for more empirical work on the (non-)exhaustivity of CRQs. More empirical information on the interpretation of CRQs will certainly help to decide as to whether Nathan's analysis applies to them, or not. We will sketch such an analysis next.

4.3 Suggestions for possible analyses of the CQRs in Hausa and Akan

Applying the analysis in Nathan (2006) to the syntactic structure in (40) yields the semantic derivation in (41) for the CRQ from (2b) above.[9] (42) gives the meaning of the full clause:

(40) $[_{DP}$ wa$_1$ $[_{DP}$ `n $[_{NP}$ t$_1$ $[_{CP}$ dà $[_{TP}$ ya táfi Kano]]]]]

(41) a. ⟦RC⟧ = ⟦dà ya táfi Kano ⟧
$= \lambda P_{<s,et>}.\lambda p_{<st>} . \exists x_e [p = \lambda w_1.[P(w_1)(x) \wedge$ x went to K. in $w_1]]$
b. ⟦NP ⟧ = ⟦wa ⟧ $= \lambda w.\lambda x.$ x is a person in w
c. ⟦NP RC ⟧ $= \lambda p_{<st>}. \exists x_e[p = \lambda w_1.[person'(w_1)(x) \wedge$ x went to K. in $w_1]]$
d. ⟦DEF NP RC⟧ $= \iota p[\exists x[p = \lambda w_1.person'(w_1)(x) \wedge$ x went to K. in $w_1] \wedge p(w)]$

(42) $[\![(2b)]\!]^w = 1$ iff $\forall w' \in DOX_{MUSA}(w)$:
$[\iota p[\exists x_e[p = \lambda w_1.[person'(w_1)(x) \wedge$ x went to K. in $w_1]] \wedge p(w)]](w')$
≈ Musa knows the unique w-true proposition of the form 'x went to Kano' (WE)

Crucially, uniqueness in (42) is evaluated relative to evaluation world *w*, and thereby not part of the doxastically accessible propositional content: (42) represents the WE-interpretation of (2b).[10]

[9] In Hausa, the definite determiner *`n/`r* follows the NP, viz. *mutumî-n* 'man-DEF' (eg. Newman 2000). We postulate, that the order NP>DET is derived by Aboh(2004)-style movement of NP to SpecDP.

[10] The formal implementation raises a non-trivial issue: the requirement that the embedded proposition be true in evaluation world *w* is satisfied by binding the *world/situation* variable (Schwarz 2009) of the CQ-definite to *w*. As mentioned below (38), this deictic behavior of the DEF-operator gives rise to a *de re*-construal. Alternatively, the

Alternatively, CRQs, and in particular those with overt specific indefinites, such as Akan (21a) and (22), may receive an analysis in terms of Xiang's (2016) analysis of *wh*-interrogatives and free relative questions; see also Caponigro (2003). The analysis appears well-suited for a number of reasons: (i.) The core of the *wh*-interrogative denotes a property (<e,st>), not a propositional set. This would correspond to the meaning of NP+CP-constituents in CRQs. (ii.) The *wh*-element is of type <e,st> and functions as a modifier on the topical property (= the background predicate), which is denoted by the rest of the interrogative. This would correspond to the role of head noun and relative clause in CRQs, which also combine by means of predicate modification. (iii.) The *wh*-core is headed by a covert answer operator ANS, selecting for the maximally informative proposition(s) in the answer space, and by a covert choice function-operator, which selects (one of) the maximally informative proposition(s). Applied to Akan CRQs, this choice function operator may be spelt out by the specific INDEF marker *ko*, given that such indefinites are often treated as choice-function denoting (Reinhart 1997).[11] Referring the reader to Xiang (2016: 14ff.), this would yield the structure in (43) for the CRQ in (22a):

(43)	[$_{DP}$	nipa$_1$	[$_{DP}$	ko	[ANS	[$_{NP<e,st>}$ t$_1$	[$_{CP<e,st>}$	aa	ɔ-kɔ-ɔ	Kumase]]
		person		CHOICE				REL	went	Kumasi

5 Conclusion

In light of the discussion, one may wonder about the cross-linguistic implications of the regular occurrence of CRQs in Hausa/Akan for the analysis of embedded *wh*-questions in English? The question is whether a unified analysis is possible on which English *wh*-interrogatives are reanalyzed as embedded CRQs, with the matrix predicate selecting for a free relative clause (Jacobson 1995, Caponigro 2003)? Xiang's (2016) analysis constitutes an important step towards a unified analysis, but it still leaves open a number questions: Do CRQs come with more limited interpretive options like the CQ-couterparts (see §4.1)? Do CRQs show a different exhaustivity behavior than *wh*-interrogatives? And why does the range of licit *wh*-expressions in *wh*-interrogatives and free relatives differ in English (Caponigro 2003)? There seemed to be no such difference between English *wh*-interrogatives and Hausa/English CRQs.

Deferring the question of whether a unified analysis for *wh*-interrogatives and relative-based questions is possible to future research, we conclude more generally that there is cross-linguistic (and language-internal) variation in the formal expression of embedded complement questions, namely as *wh*-interrogative questions or CRQs (or free relatives). This raises the issue of whether there is a corresponding difference in the semantic interpretation of embedded questions. However, the interpretion of concealed questions as SE, IE, WE, or NE has been little explored so far, not to mention the interpretation of CRQs in Hausa and Akan. It was shown that existing formal analyses of concealed questions differ in their predictions regarding the exhaustivity of

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world variable may be bound by the matrix predicate, on a *de dicto*-construal. Uniqueness would then be established relative to the doxastically accessible worlds, thereby giving rise to SE-readings. Notice that the *de re* (world) analysis clashes with the *No de re*-constraint on CQs illustrated in (31) for English. More research is required.

[11] Notice that the Hausa element *wa(a)*, which is found as *wh*-element in *wh*-interrogatives and as an unspecific person head noun in CRQs, also forms part of the specific indefinite determiners *wani* (m.), *wata* (f.), *wasu* (pl.), thereby motivating a choice function analysis for Hausa CRQs as well.

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questions, thereby raising the need for substantial empirical work on CRQs in Hausa and Akan and on concealed or free relative questions in English alike.

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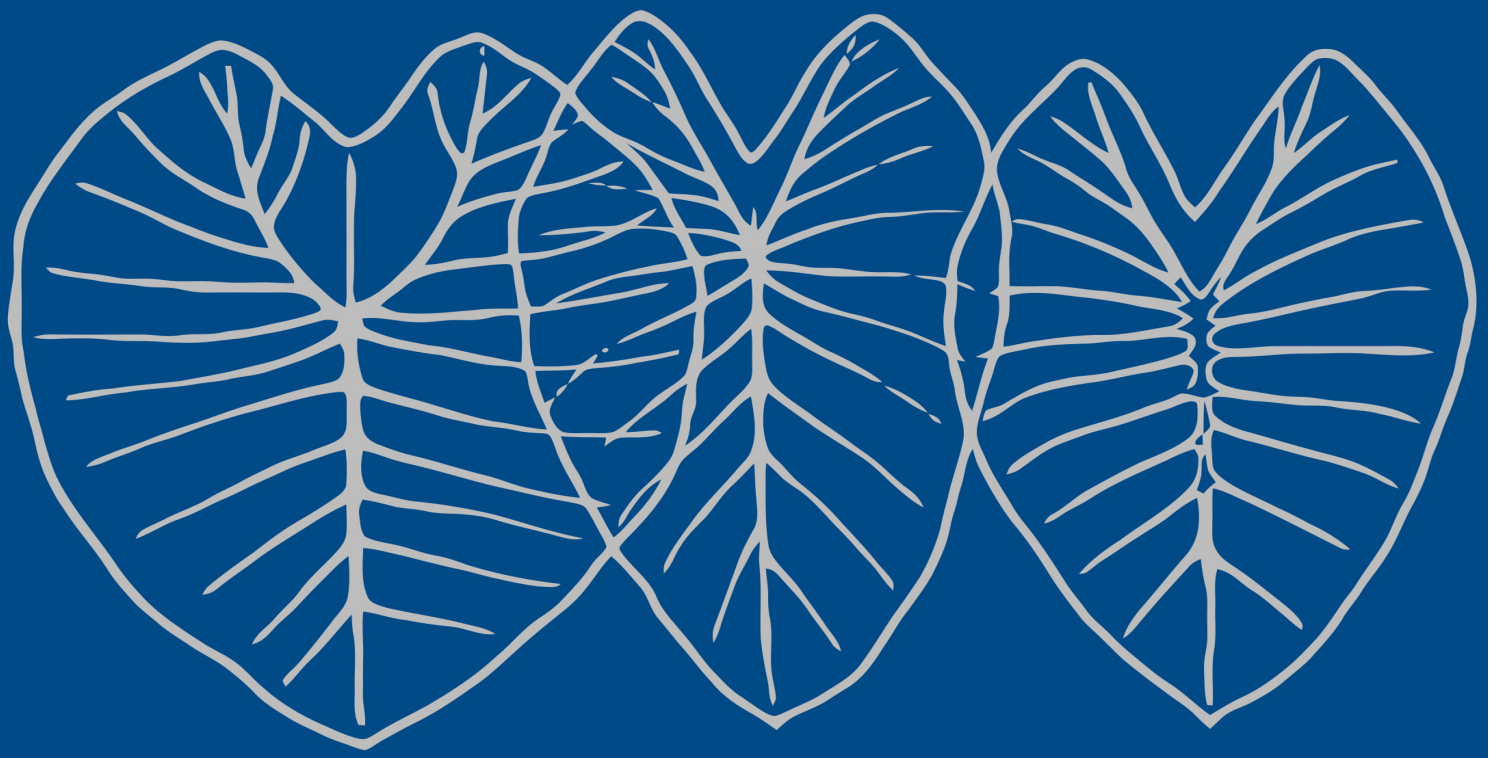

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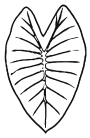

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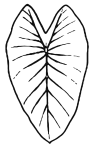

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